

Changing the course: from boring numeracy to inspiring literacy

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Outline



I will summarize my experiences of changing a large intro stats course that had been running unchanged — for too long time.

1. Facing the challenge
2. **Changing the course**
3. Results and conclusions

1. Facing the challenge

The setting when I faced the challenge (in 2008):

- ▶ **Approach:** mathematical formulas, manual calculations, technical details, irrelevant examples, out-of-date content
- ▶ **Needs:** understanding statistics and its essential role in society, media, research, policy making etc. – everywhere!

A GAP: a good chance to make a big change!
(says the optimist)



1. Facing the challenge

Challenge:

how to teach "intro stats" in Social Sciences?
(so that it won't be a "*bye forever stats*", anymore)

Situation:

- ▶ compulsory for 300 new students every year
- ▶ bad reputation: out-of-date, out-of-context
- ▶ preconceived ideas about "boring statistics"
- ▶ many students afraid of mathematics



1. Facing the challenge

Conclusion:

- ▶ **Radical change** required
(minor tuning would not help).
- ▶ A change in **attitudes** needed
(at least in the long run).

Possibility:

to change the course completely! (*be positive!*)



2. Changing the course

I wanted to create a course that would **introduce statistics** as an **interesting, important** and **useful** part of the Social Sciences.

Three essential ideas in making the change:

- ▶ A) Highlight **statistical literacy**
- ▶ B) Focus on fundamental topics
- ▶ C) Simplify structure and schedule



2. A) Highlight statistical literacy

Note: These students will not be statisticians, but they need to understand the importance of statistics for their studies.

Statistical literacy – the key for **motivation**:

- ▶ Show how stats is used in **Social Sciences**.
- ▶ Underline the **role of statistics** in society.
- ▶ Use real **questionnaires** and **data**.
- ▶ Avoid (or skip) technical details.



2. A) Highlight statistical literacy

Introduce important concepts, seek answers to relevant questions:

- ▶ How to **measure** multidimensional social phenomena?
- ▶ What kind of data to **collect**, from whom, and how?
- ▶ How to create **valid** and **reliable** questionnaires?
- ▶ Meaning of the concepts of **variation** and **dependence**?
- ▶ Effects of **randomness** and **chance** to statistical research?
- ▶ What must be **assumed** when **applying** statistical **methods**?
- ▶ How to draw reliable statistical and **substantial conclusions**?
- ▶ How to **interpret** statistical results, graphs and tables?
- ▶ What is the role of the computer and statistical **software**?
- ▶ How to (not) lie with statistics?

These helped to form the fundamental topics of the course:



2. B) Focus on fundamental topics

Note: Intro course is a good reason to **cut out** many topics. Instead, **encourage to continue** studies on further courses.

Five themes of Part 1 with short descriptions of topics:

▶ **1: Statistics and survey research**

Statistics is needed everywhere! Survey research dominates in Social Sciences. Importance of statistical literacy in society.

▶ **2: Measurement in social sciences**

Uncertainty of measurement. Importance of valid and reliable measurement. Cooperation of substance and statistics from the beginning of each and every research project.



2. B) Focus on fundamental topics

Five themes of Part 1, continued:

- ▶ **3: Data collection, graphs and statistics**
Need a random sample to study a population. All data sets are not random samples. Visualizing statistical data: powerful way to present information. Numerical statistics as a support.
- ▶ **4: Variation and dependence**
Key issues of statistics, helpful in most research questions. Variation is more statistical, dependence more substantial. Scatter plot and its various functions and interpretations.
- ▶ **5: Cross tabulation**
Dependence continued, with discrete variables. Important way of describing data but also a method to analyze dependencies.

Part 2 continues with another five themes:



2. B) Focus on fundamental topics

▶ **6: Chance, randomness, and probability**

Difference of systematic and random. Role of pure chance.
Effects of uncertainties through the concept of probability.

▶ **7: Binomial and normal distributions**

Probability distributions compared by analogy with empirical distributions, discrete/continuous. Only two important ones.

▶ **8: Estimation and confidence intervals**

Statistical inference: making conclusions based on a sample.
Uncertainty of estimating the population parameters.

▶ **9: Hypothesis testing and significance**

Rather critical view to statistical testing of hypotheses.
Stress substantial results, not just plain statistical significance.

▶ **10: Regression and one-way ANOVA**

Get a grasp of basic methods used widely in Social Sciences.
Apply learned concepts and pave the way for further studies.



2. C) Simplify structure and schedule

Simple structure: Parts 1 and 2 with five themes each.

Simple schedule: Each Part takes 7 weeks as follows:

Weeks 1–5:

- ▶ Thu: lecture: new theme, exercises for homework
- ▶ Mon/Tue: voluntary workshops for supporting the exercises, supervised by 2 assistants (students of statistics)
- ▶ Wed: lecture: theme summary by discussing the solutions to exercises

Week 6:

- ▶ Mon/Tue: voluntary extra workshops for supporting the exercises of the whole part, supervised by 3 assistants

Week 7:

- ▶ exam (points for the grades of 0–5)



3. Results and conclusions

The **results** that are based on

- ▶ my own experiences and reflections (2008–13)
- ▶ continuous feedback from students
- ▶ discussions with assistants and colleagues
- ▶ comments from all around the University

are **extremely positive and encouraging.**



3. Results and conclusions

The course has become famous, attracting more and more students from all over the University.

The most important result is the impact:

Increasing number of students now continue their **statistics studies** and use **statistical methods** in their BSc, MA, and PhD theses.

"We want more!" (instead of "we hate this")!



3. Results and conclusions

I repeat the essential ideas behind the change:

- ▶ A) Highlight **statistical literacy**
- ▶ B) Focus on fundamental topics
- ▶ C) Simplify structure and schedule

To conclude:

Changing the course was a **tremendous success.**

Even a change of **attitudes** can be seen:
statistics is no more boring, but instead
important, interesting – even inspiring!

